Group Instructions for Demographic and Threat Table Ranking

Nassau Grouper – January 2014

I. Demographic Factor Analysis

1. Scoring

To evaluate the potential impact of each demographic factor, each member is allotted **five** likelihood points to allocate across the rank scale listed below. These **five** likelihood points account for uncertainty in the ranking. All five of the likelihood points MUST be allocated for each demographic factor. For example, one might consider abundance to be a demographic factor risk in one specific geographic area but not others and indicate that by using 2 points for "low risk" and 3 points under "moderate risk." Or data may be contradicting on the effect of connectivity and therefore the points may be allocated between "very low risk" and "low risk." All five of the points must be distributed for each demographic factor (they must sum to 5) and only whole numbers are permitted. Insufficient data to score the demographic factor severity is indicated under "0" for Unknown. If a member chooses 0 (Unknown) for a threat, all 5 points must be assigned to that category only. Each member is to individually distribute the 5 points per threat on a scale of one to five according to the following risk description:

- 0 - Unknown
- 1 Very Low Risk - Unlikely that this demographic factor affects species' overall status.
- 2 Low Risk – This demographic factor may affect species' status, but only to a degree that it is unlikely that this factor significantly elevates risk of extinction.
- 3 Moderate Risk - This demographic factor contributes significantly to long term risk of extinction, but does not constitute a danger of extinction in the near future.
- 4 Increasing Risk - Present demographic risk is low or moderate, but is likely to increase to high risk in the foreseeable future if present conditions continue.
- 5 High Risk - This demographic factor indicates danger of extinction in the near future.

2. Interaction Column

When ranking each demographic factor, members should consider the potential for interaction between demographic factors or threats. The impact of demographic factors and threats can be interconnected and the impact of one demographic factor or threat may increase or decrease the ranking of another demographic factor. Group members should consider these connections and rank each demographic factor accordingly.

If the demographic factor is ranked higher due to combined effects of other demographic factors or threats, identify those factors or threats (by number) that caused you to score the risk higher than it would have been if it were considered independently. For example, if you ranked the demographic factor "abundance" higher risk than you would have independently because of the threat of “fishing spawning aggregations” and “law enforcement”, you would put in numbers 7 and 17 under the interaction column.

3. Questions to help with evaluating demographic risk

A. <u>Abundance Questions</u>

Is the species’ abundance so low that it is at risk of extinction due to environmental variation or anthropogenic perturbations (of the patterns and magnitudes observed in the past and expected in the future)?

Environmental variation includes fluctuations in environmental and oceanographic conditions (such as oceanographic regime shifts and El Niño events), local disturbances (natural and anthropogenic), and environmental catastrophes. Anthropogenic perturbations include any human activity that directly or indirectly poses demographic risks to the species.

Is the species’ abundance so low, or variability in abundance so high, that it is at risk of extinction due to depensatory processes?

Very low levels of species abundance and density may be insufficient to support mate choice, sex-ratios, fertilization and recruitment success, reproductive or courting behaviors, foraging success, and predator avoidance behaviors. A species exhibiting high variability in abundance and/or population growth rate may also experience strong depensatory risks at low points in its variability.

Is the species’ abundance so low that its genetic diversity is at risk due to inbreeding depression, loss of genetic variants, or fixation of deleterious mutations?

Is a species’ abundance so low that it is at risk of extinction due to its inability to provide important ecological functions throughout its life-cycle?

Organisms may modify both their physical and biological environments in various ways throughout their life-cycle. Inability to affect these modifications can limit population production, and degrade habitat conditions for other organisms as a whole. The abundance levels required for these effects depend largely on the local habitat structure and particular species’ biology.

Is a species’ abundance so low that it is at risk due to demographic stochasticity?

Demographic stochasticity refers to the seemingly random effects of variation in individual survival or fecundity that are most easily observed in small populations. As species’ abundance declines, the relative influences of environmental variation and demographic stochasticity change – with the latter coming to dominate.

Species status evaluations should take uncertainty regarding abundance into account.

Abundance estimates always contain observational error, and this should be taken into account with deference to the species. Additionally, short-lived species with wide inter-annual variations in abundance contribute to uncertainty about average abundance and trends. For these reasons, it would not be prudent to base an assessment of risk to a species' abundance on a single high or low observation. Depending on the circumstances, a species may be considered to be at risk if it satisfied the above conditions on average over a short period of time.

B. <u>Growth Rate/Productivity Questions</u>

Is a species' average population growth rate below replacement and such that it is at risk of satisfying the abundance conditions described above?

Is the species' average population growth rate below replacement and such that it is unable to exploit requisite habitats/niches/etc. or at risk due to depensatory processes during any life-history stage?

Very low levels of species population growth rate may be insufficient to support mate choice, sex-ratios, fertilization and recruitment success, reproductive or courting behaviors, foraging success, and predator avoidance behaviors.

Does the species exhibit trends or shifts in demographic or reproductive traits that portend declines in per capita growth rate which pose risk of satisfying any of the preceding conditions?

Changes in metrics, such as average size of mature individuals or average fecundity, that affect the instantaneous per capita growth rate are often more easily and precisely quantified than are changes in abundance, and may provide a more direct indication of declining growth rate.

Species status evaluations should take into account uncertainty in estimates of growth rate and population growth rate-related parameters.

To estimate long-term trends it is important to have an adequate time series. Unfortunately, such time series, when they exist at all, are often short, contain large observational errors, and/or exhibit gaps in observation. These constraints may greatly limit the power of statistical analyses to detect ecologically significant trends before substantial changes in abundance or distribution have occurred.

C. <u>Spatial Structure and Connectivity Questions</u>

Are habitat patches being destroyed faster than they are naturally created such that the species is at risk of extinction due to environmental and anthropogenic perturbations or catastrophic events?

With habitat being continually created and destroyed by natural processes, human activities should not severely reduce the area of distribution, or the number of habitat patches. Strong negative trends in the amount of available habitat deterministically increase extinction risk, *although the relationship between decreasing the number/size of patches and extinction risk is not necessarily linear.*

Are natural rates of dispersal among populations, metapopulations, or habitat patches so low that the species is at risk of extinction due to insufficient genetic exchange among populations, or an inability to find or exploit available resource patches?

Is the species at risk of extinction due to the loss of critical source populations, subpopulations, or habitat patches?

Some populations, subpopulations, and habitat patches are naturally more productive than others. In fact, a few patches may operate as highly productive sources for several sinks that are not self-sustaining. Although potentially representing only a small fraction of the species' total distribution, declines in abundance or population growth rate of source populations may portend drastic declines for the species as a whole. However, it should be recognized that spatial processes are dynamic, and specific source and sink populations may exchange roles over time.

Analyses of species' spatial processes should take uncertainty into account.

Often, little information is available on how spatial processes relate to a species' extinction risk. As a default, it should be assumed that historical spatial processes and population structure were sustainable, but it is uncertain whether novel population structure will be.

D. <u>Diversity Questions</u>

The loss of diversity can reduce a species' reproductive fitness, fecundity, and survival, thereby contributing to declines in abundance and population growth rate and increasing extinction risk (e.g., Gilpin and Soulé 1986). There is some uncertainty, however, whether the loss of diversity by itself confers a risk of extinction (see Brook et al. 2002). Although the loss of diversity certainly increases extinction risk through its compounding effects on other demographic factors, it is argued by some that the loss of diversity by itself plays a relatively minor role in extinctions. The loss of diversity can help bring species to a high risk status, but other demographic or environmental factors usually play the direct role in causing extinctions (Lande 1988, Caro and Laurenson 1994, Caughley 1994, Dobson 1999). In general, risks to a species' diversity are most pertinent to the consideration of whether it is likely to become in the foreseeable future an endangered species throughout all or a significant portion of its range (i.e., whether the species is threatened).

Is the species at risk due to a substantial change or loss of variation in life-history traits, population demography, morphology, behavior, or genetic characteristics?

Many of these traits may be adaptations to local conditions, or they may help protect populations against environmental variability. A mixture of genetic and environmental factors usually causes *phenotypic diversity, and the substantial loss of phenotypic diversity may indicate elevated risk even if current genetic techniques or data are unable to resolve a genetic basis.*

Is the species at risk because natural processes of dispersal, migration, and/or gene flow among populations have been significantly altered?

Is the species at risk because natural processes that cause ecological variation have been significantly altered?

Phenotypic diversity can be maintained by spatial and temporal variation in habitat characteristics. Processes that promote ecological diversity, including natural habitat disturbance regimes and factors that maintain habitat patches of sufficient quality, should not be significantly altered.

Species status evaluation should take uncertainty about requisite levels of diversity into account.

Our understanding of the role that diversity plays in species viability is limited. The historical representation of phenotypic diversity serves as a useful "default" guideline for evaluating species status.

II. Threat Analysis Ranking

The Threat Analysis Table on the bottom portion of the scoring matrix lists the threats to Nassau grouper as discussed in the status report. Each threat is associated with an ESA factor as listed in section 4(a)(1): A) the present or threatened destruction, modification, or curtailment of its habitat or range; B) overutilization for commercial, recreational, scientific, or educational purposes; C) disease or predation; D) inadequacy of existing regulatory mechanisms; and E) other natural or man-made factors affecting its continued existence. The section(s) in the Status Report where discussion of each threat may be found, if it is not a stand-alone section, is in parentheticals. In describing the threats facing the species, each member will qualitatively rank the severity of the identified threats to the species range-wide. Keep in mind that, while a threat may not necessarily affect the species to the same degree throughout its range, you still need to assess how significant the threat is at a range-wide scale (i.e., even if a threat only acts on a portion of a species' range, how does it affect the species' extinction risk throughout its entire range?). You have the opportunity in section III to identify specific geographic areas that may be more at risk and to identify what threats are acting on the species in that particular geographic area that make it more at risk.

1. Scoring

To evaluate the potential impact of each threat, each member is allotted **five** likelihood points to allocate across the rank scale listed below. These **five** likelihood points account for uncertainty in the ranking. All five of the likelihood points MUST be allocated for each threat. For example, one might consider commercial harvest to be a threat in one specific geographic area but not others and indicate that by using 2 points for "low risk" and 3 points under "moderate risk." Or data may be contradicting on the effect of artificial selection and therefore the points may be allocated between "very low risk" and "low risk." All five of the points must be distributed for each threat (they must sum to 5) and only whole numbers are permitted. Insufficient data to score the threat severity is indicated under "0" for Unknown. If a member chooses 0 (Unknown) for a threat, all 5 points must be assigned to that category only. Each group member is to individually distribute the 5 points per threat on a scale of one to five according to the following risk description:

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- 5 High Risk - This threat indicates danger of extinction in the near future.

2. Interaction Column

When ranking each threat, group members should consider the potential for interaction between demographic factors or threats. The impact of demographic factors and threats can be interconnected and the impact of one factor or threat may increase or decrease the ranking of another threat. Group members should consider these connections and rank each threat accordingly.

If the threat is ranked higher due to combined effects of other demographic factors or threats identify those factors or threats (by number) that caused you to score the risk higher than it would have been if it were considered independently. For example, if you ranked "artificial selection" higher risk than you would have independently because of the threat of "fishing spawning aggregations" and "commercial harvest", you would put in numbers 7 and 5 under the interactions column.

3. Foreseeable Future

The foreseeable future is defined as 30 years for Nassau grouper. Thirty years was chosen based on the generation time for Nassau grouper as described by Legault and Eklund.[1] Legault and Eklund stated "generation time for Nassau grouper is probably on the order of 10-30 years, but may be much larger than that if M (natural mortality) is low and there is a large increase in

[1] Legault, C.M. and Eklund, A. 1998. Generation times for Nassau grouper and jewfish with comments on M/K ratios (revised). NMFS SEFSC Contribution SFD-97/98-10A

spawning frequency with age." We chose 30 years to be conservative and to allow at least three generations of mature individuals to contribute to spawning aggregations if generation time is on the lower side of the estimate. This was also the period we thought you could predict and rank both demography and threats. So for any demographic factor or threat factor you are evaluating, if you think you cannot evaluate out 30 years, please make specific comment and rank it at the scale you determine.

Comments about ability to predict demography and threats at a 30 year timeframe:

4. PECE Policy

In addition to interactions and the foreseeable future, members should be aware of an Endangered Species Act (ESA) policy on how to consider conservation efforts to the status of a species (both now and into the foreseeable future). When judging the efficacy of existing protective efforts, we are to rely on the "Policy for Evaluation of Conservation Efforts When Making Listing Decisions" (PECE; 68 FR 15100; March 28, 2003). The PECE policy is designed to guide determinations on whether any conservation efforts that have been recently adopted or implemented, but not yet proven to be successful, will result in recovering the species. According to the PECE policy there are two criteria to consider if conservation efforts that have not yet been implemented, or have been implemented but have not yet demonstrated effective: (1) The certainty that the conservation efforts will be implemented, and (2) the certainty that the efforts will be effective. If you moderate your ranking score based on conservation efforts, please ensure they meet these two criteria.

III. Geographic Area Question

The final consideration for members is to identify any geographic area that is essential to the viability of the species. Group members should identify each specific geographic area(s), the threat(s), and the level of threat(s) acting in that specific area.

Comment (s):

IV. Other Comments

Please feel free to provide any other comments you feel are relevant in evaluating the extinction risk analysis for Nassau grouper.

Comment(s):

Results of Voting

0	1	2	3	4	5	Threat Level
0%	0%	5%	35%	33%	27%	Abundance
0%	5%	5%	22%	42%	27%	Growth rate/productivity
0%	8%	13%	25%	42%	12%	Spatial structure and connectivity
8%	7%	15%	43%	23%	3%	Diversity
0%	2%	12%	32%	25%	30%	Commercial harvest
0%	0%	0%	23%	22%	55%	Historic harvest
0%	0%	2%	15%	33%	50%	Fishing spawning aggregations
25%	5%	8%	30%	23%	8%	Artificial selection
0%	8%	32%	20%	28%	12%	Habitat alteration
33%	17%	17%	17%	17%	0%	Climate change
30%	52%	10%	8%	0%	0%	Disease, Parasites, & Abnormalities
25%	48%	7%	2%	17%	2%	Aquaculture
33%	17%	12%	22%	2%	15%	International Trade Regulations
8%	8%	7%	26%	31%	20%	Foreign countries jurisdictional waters
0%	53%	22%	22%	3%	0%	U.S. Federal
0%	30%	27%	30%	8%	5%	State and territory regs
0%	0%	8%	25%	20%	47%	Law enforcement